magnetic particles are coated with streptavidin for example, a suitable bifunctional reagent may be a biotinylated antibody specific for the target in the sample. Alternatively, one could directly modify surface of magnetic particles to immobilize entity having specific feature for binding with species of interest. Regardless of how the surface of the magnetic particle are modified, this process will allow the target to selectively bind to the magnetic beads. The concentration of beads is chosen based on the amount of target species expected to be present in the sample.

[0121] After the sample has been treated to effect labeling of the target species, the sample is optionally filtered or otherwise treated to remove debris that might clog device channels or otherwise interfere with the process. Examples of material that may be filtered from a sample includes coagulated sample materials, precipitates, etc.

[0122] Next, after incubation and optional filtering, the sample (with magnetic particles now labeling the target) is introduced as continuous flow to one or more inlets to magnetophoretic device. Simultaneously buffer solution is introduced to one or more other inlets to magnetophoretic device. See block **611**. From this point, the sample flows past one or more magnetic field gradient generators in the device under conditions that cause magnetic particles to deflect into a buffer stream and toward an active material outlet. See block **613**. The process optionally passes the through a second magnetic field gradient generator in the device—downstream from the first magnetic field gradient generator to effect further purification. Finally, the magnetic particles with purified target species are collected in an outlet channel. See block **615**.

[0123] In the depicted process, the collected target (labeled with magnetic particles) is subjected to three separate post-processing operations. Each of these operations is described in greater detail elsewhere herein. In a block **617**, a post-processing station lyses the collected target cells. In some embodiments, the lysis is conducted while cells are held stationary. This operation may be appropriate for analysis of pathogens such as bacteria for example. In some examples, the lysed pathogen provides components such as genetic material, particular organelles, or other characteristic biological or chemical components for detection. Next, as shown in a block **619**, a further post-processing station optionally amplifies the contents of the lysed target to produce an increased signal of a target sequence of interest. Amplification is primarily relevant when particular genetic material is to be analyzed or detected. PCR or other known amplification techniques may be appropriate for this purpose.

[0124] In some embodiments, one or both of the lysis operation or the amplification will be unnecessary and the process is performed without one or both of them but with an additional detection operation as depicted at a block **621**. In other embodiments, each of operations **617**, **619**, and **621** is performed in turn. Regardless of the exact sequence of post-processing operations, a detection station may detect the presence of the target via a microscopy, a fluorescent signature, a radioactive signal, etc. Examples of detection processes suitable for use with the invention include continuous flow processes such as various cell counting techniques or immobilization techniques such as microarray analysis.

[0125] Integrated CMACS Systems

[0126] As indicated above, various operational modules may be integrated in a microfluidics system, and in some cases on a single microfluidics chip. These modules may be sorting stages arranged in series and/or in parallel as depicted in FIGS. **1** and **5**, for example. In addition, other modules or subsystems may be provided in a microfluidics system.

[0127] Further, as depicted in FIG. **7**A, a microfluidics system may be designed with modules located upstream and/or downstream from the sorting station. The embodiment of FIG. **7**A includes at least three general subsystems: a pre-processing subsystem **701**, a sorting subsystem **703**, and a post-processing subsystem **705**. In some embodiments, two or all three of these subsystems are provided on a single device.

[0128] In the depicted embodiment, the pre-processing subsystem **701** includes a first inlet channel **709** for receiving the sample and one or more additional inlet channels (represented by second inlet channel **711**). Depending on the design and application, these additional channels may be used to introduce magnetic particles, diluents, additives for tailoring rheological properties, etc. Pre-processing module **701** also includes an outlet channel **715** for providing labeled sample to the sorting subsystem **703**. The pre-processing module **701** may optionally include one or more other outlets (not shown). As an example, the pre-processing subsystem may include modules or stations for filtering the sample, concentrating or diluting a sample, providing additives to adjust rheological properties of the sample, labeling the sample with the magnetic particles, disrupting sample components (e.g., lysis, viral protein coat disruption, etc.), and the like.

[0129] Typically, though not necessarily, sorting subsystem **703** will include one or more MFG-based sorting stations including at least a buffer inlet channel **717**, a sample inlet channel **715**, a waste outlet channel **713**, and a collection channel **719** as described above. If a fractionation sorting module is employed, there will be multiple collection channels.

[0130] The post-processing subsystem **705** receives magnetically labeled target components via the collection channel **719**. It expels processed fluids via an outlet channel **721**. Subsystem **705** also optionally includes one or more inlets **723** for providing fluids necessary for effecting one or more post-processing operations (e.g., chemical lysing reagent or primers, nucleotides, polymerase, etc. for PCR). The post-processing subsystem may include modules for direct detection of the target via an appropriate detection technique, and it may optionally include additional pre-detection modules such as a lysis module or and amplification module as described herein. A detection module and any additional module may be implemented in one or more stations.

[0131] A controller is commonly employed to control the operations of an integrated microfluidics system. Algorithms implemented on a controller control the sequence and timing of flow to various modules through various ports, temperature cycling, application of magnetic and/or electric fields, and optical excitation and detection schemes, for example. While the controller is not shown or described extensively herein, one of skill in the art will understand that controllers may be employed with sorting modules and larger integrated systems herein. Controllers interpret signals from various sensors (if present) associated with the microfluidics device and provide instructions for controlling operations on the microfluidics system. All this is accomplished under the control of hardware and/or software logic, which may be implemented on a dedicated, specially designed microprocessor system or a specially configured general purpose computing system.